

PAGES

PAST GLOBAL CHANGES

A CORE PROJECT OF THE INTERNATIONAL GEOSPHERE-BIOSPHERE PROGRAMME IGBP

News of the International Paleoscience Community Volume 3, Number 1 - March 1995

EDITORIAL

In the Perspective of the Past

To compensate for the enhanced anthropogenic greenhouse effect, the Earth surface and the near-surface air masses warm up in order to emit more infrared radiation and to establish a new radiation equilibrium. Model experiments attempt to calculate how this adjustment will take place. But it is another big step to go from knowledge of changes in meteorological parameters, already an extremely difficult task, to comprehension of what these changes really mean for the environment and society. How will vegetation adapt to changing climatic conditions, pollution stress, effects of increasing CO₂? How will fluvial systems, after thousands of years of relatively constant conditions, adjust to changing precipitation characteristics? What measures should be taken in order to cope with these events?

It has become evident that the basic information in this type of assessment will come from the reconstruction of Earth-system evolution. The PAGES/CLIVAR (Climate Variability, WCRP/WMO) collaboration attempts to extend the detailed knowledge of the variability of the system back in time. This is necessary, for example, to better understand the modulation of El Niño-Southern Oscillation (ENSO) events with changing climate. Based on paleodata of meteorological parameters, climate modellers try to understand the physical control of ENSO events in order to make predictions regarding possible climatic changes related to ongoing anthropogenic forcing.

But the contribution from paleodata goes much further. For interaction with climate modellers, data with high temporal resolution which can be directly converted into model parameters, such as isotopic data from coral, play an important role. But data on vegetation changes, geomorphological changes, or changes in the characteristics of fluvial systems often are considered much too vague to be used for validation of physical models. This is understandable, but our task is not restricted to the first step of learning to model changes in only meteorological parameters. Our task goes much further: we need to develop scenarios for the possible impacts on the environment and man. For this second step, reconstructions of changes in vegetation, in river systems, or changes in the frequency and extent of extreme events constitute invaluable case histories of previous change-impact events.

It is very important that we keep this in mind. As fascinating as the progress of computer capabilities and their use in modelling of complex system are, critical information on possible future impacts will come from reconstructions of experiments that nature performed on a scale of 1:1.

H. Oeschger, Chairman of PAGES Scientific Steering Committee

PAGES IMPLEMENTATION

Following the PAGES/PEP II planning workshop in Beijing, April, 1994, paleo-scientists from the participating countries actively sought to plan their future work in response to this important PANASH transect.

Integration of the PEP II Projects within a State-level Scientific Program in China

In May 1994, the PEP II co-leader, Liu Tungsheng, organized a meeting of leading scientists from the Chinese Academy of Science to discuss the research activities and priorities in China in connection with PEP II. They agreed that the best approach is to integrate the Chinese PEP II projects into State-level scientific programs. A project proposal has been submitted to the State Science and Technology Commission and National Natural Science Foundation through the Chinese Academy of Sciences.

China constitutes a key area in PEP II, because it is subjected to the interactions of critical climatic components of atmospheric circulation, including the sub-Arctic cold (northwest) monsoon, the tropical and subtropical Pacific (southeast) and Indian Ocean (southwest) monsoons, and the westerlies. It also includes the Tibetan Plateau, which plays an important role in global paleoclimate changes. Chinese scientists suggest that the research activities in China should be focused on the evolution of these atmospheric components and their interactions, through the study of paleo records along three sub-transects within China. These activities will be coordinated with those of the adjacent countries so that research in China can be integrated into the overall PEP II framework.

Another important aspect planned for this program is development of a database of all paleoclimate data within China. This effort will augment present database activities, which focus on

late Quaternary paleo-data from northern China, part of a State project entitled «Environmental evolution in arid and semi-arid regions over the past 150,000 years.»

Abstracted from a report by Liu Tungsheng,
TEL: +86-1-202 7766 ext. 345;
FAX: +86-1-255 8066.

PEP II Now Present in the Australian Research Council

The National Committee for Quaternary Research (Australian Academy of Science) decided to facilitate a major proposal to the Australian Research Council (ARC) for the period 1996-1998 that consolidates a number of individual projects, which contribute to the PEP II transect in Australia.

The National Committee selected the framework of the PAGES Project because it is becoming a focus of international Quaternary science and because the climatic stages of the last interglacial, last glaciation and Holocene are particularly important for understanding climatic changes. Thus the Committee wishes to encourage Quaternary researchers with projects covering all or part of the last 150,000 years to join together in a major proposal to ARC that is endorsed by the National Committee for IGBP. The component projects must, however, relate to the PEP II transect, and to the key scientific issues outlined in the PEP II report. J. Dodson is one of the PEP II co-leaders.

Abstracted from a report in «Quaternary Australasia», Nov. 1994, 12/2: 6-7, by E. Colhoun.
For more information: J. Dodson,
TEL: +61-2-697 4390; FAX: +61-2-313 7878;
E-Mail: j.dodson@unsw.edu.au.

PAST WORKSHOPS

Pages Workshop on Dating Techniques and Comparability of Chronologies

The PAGES Dating Workshop was organised as part of the 15th International Radiocarbon Conference held in Glasgow (U.K.). The one day workshop, (13 Aug. 1994) organised by W. Mook, covered a range of dating techniques applicable to PAGES projects. About 65 people were registered, and over 100 attended at some of the lectures.

H. Heijnis described the archives of past climate in peat and how they can be dated. The main emphasis was on the application of U/Th dating to interglacial and PAGES Time Stream II samples.

Two papers discussed important new varved lakes in Germany (I. Hajdas) and Poland (T. Goslar). In both cases, plant macrofossils in the sediments have been AMS-radiocarbon dated and compared to varve dates. The results were not concordant with E. Bard's coral dating of the Younger Dryas and Allerød, and if correct would change the radiocarbon calibration at this critical glacial/interglacial transition.

B. Kromer gave a brief update on the German oak and pine chronologies. Work by Becker since the publication of the 1993 radiocarbon calibration and by others since his death in February of last year, has extended the pine chronology by 200 years. The link between the pines and oaks at 10 ka, on which the calibration depends, is still tentative.

E. Bard discussed the use of ^{14}C as a palaeoceanographic tool, concentrating on the last glacial/interglacial transition. The reservoir effect was greater in the Younger Dryas than in the post glacial – 800 yrs rather than 400 yrs. On the causes of the ^{14}C plateau in the Younger Dryas, models suggest that it could have been caused either by a step change in the production of ^{14}C related to geomagnetic changes or by a step change in oceanic thermohaline circulation.

C. Hammer reviewed the dating of ice cores by glaciologic modelling. So far, the best dating record for Greenland comes from Dye 3. The age of the top of Dye 3 has been verified by finding bomb-related isotope activity peaks. The slow deposition rate at the GRIP and GISP2 sites makes layer counting difficult below 4000 yrs. Layer counting of Dye 3 is ± 30 at 8000 yrs, so the new cores are no better than this. The period from 70 ka back to the Eemian will be very difficult to date satisfactorily in the new Summit cores.

Abstracted from a report by J. Pilcher,
TEL: +44-1232-245 133 #3977;
FAX: +44-1232-321 280;
E-Mail: jpilcher@geos_01.gg.qub.ac.uk.

Paleoclimates of Arctic Lakes and Estuaries Symposium

The Paleoclimates of Arctic Lakes and Estuaries (PALE) Task presented recent results of the project at the Geological Society of America Meeting, Seattle, 24-27 Oct., 1994. Fifteen papers were organized into a GSA Theme Session organized by G.H. Miller and J.T. Andrews. The papers covered a wide variety of topics, including pollen and other microfossils, isotopes, lake level, physical limnology, and climate modelling. Study areas included much of the Arctic, especially the Canadian Arctic and Baffin Island, but also including Alaska, Siberia, and Iceland. Chronology was an important issue, especially radiocarbon dating. The diversity of research results and disciplines bodes well for continued success of PALE.

Report by G.H. Miller, University of Colorado,
TEL: +1-303-492-6962; FAX: +1-303-492-6388;
E-Mail: gmiller@spot.colorado.edu.

PAGES Workshop on Reconstruction of Climatic Records in Monsoon Asia during Historical Times

A PAGES workshop on «Reconstruction of Climatic Records in Monsoon Asia during Historical Times: Methodology and Data archives» was held in Beijing, China, 18-20 Nov. 1994. Thirty-two scientists from four countries (USA, Japan, Switzerland, and China) participated. The emphasis was on the wealth of historical documents in the monsoonal Asia region and the importance of historical reconstructions to global change studies, especially for validation of global climate models. The objectives of the workshop were to compare and standardize methodologies used in extracting paleoclimate data from historical sources and to initiate procedures for creating computer-readable archives of climate-related historical data.

For more information: W.-C. Wang,
TEL: +1-518-442 3380; FAX: +1-518-442 3360;
E-Mail: cuddy@climate.asrc.albany.edu.

ADDITIONAL ITEMS

Permafrost and Climate Change

The World Data Center A for Glaciology (Snow and Ice) has published a report entitled «Permafrost and Climate Change; an Annotated Bibliography.» Compiled by E. Koster (The Netherlands) and A. Judge (Canada), this work provides an extensive guide to literature on sediment conditions and ground ice under changing climate conditions at high latitudes and mountain areas. For information on receiving this report contact: World Data Center A for Glaciology, CIRES, Campus Box 449, University of Colorado, Boulder, CO 80309-0449, USA, TEL: +1-303-492-5171; E-Mail: nsidc@kryos.colorado.edu

PEP III – Paleomonsoons Cross-Project Interaction

A coordinating meeting was held in Paris-Orsay, France, 5 Dec. 1994, by S. Kröpelin (Paleomonsoon Project) and F. Gasse (PEP III). Monsoons are a major subsystem of past global climates and a common element of several PAGES project initiatives. Within the limits of present-day dating accuracy, marine and terrestrial research of the last few years suggests synchronous variations in Holocene monsoon circulation affecting at least the northern hemisphere low latitudes from the Atlantic to central Asia. The following actions are planned: to provide a forum for relevant presentations in the form of a symposium «Paleomonsoon Variations and Global Change during the Late Quaternary» at the XIV INQUA Congress in Berlin, Aug. 1995; to prepare joint review papers with maps and a selective bibliography on the present state of knowledge of the African, Indian, and East Asian monsoons at 18 ka, 9 ka, and 6 ka in order to link the PEP transects, Paleomonsoons, and PMIP efforts; to organize a coordinating workshop for this aim as an INQUA-PAGES Paleomonsoons Project activity in 1995; to raise the attention of the modeling community to the climatic instability around 6 ka as indicated by several paleoclimatic records, especially in tropical Northern Africa; and to establish and distribute a directory of scientists active in paleomonsoon research.

Abstracted from a report by S. Kroepelin, TEL: +49-30-838 4887; FAX: +49-30-838 6263; E-Mail: skroe@zedat.fu-berlin.de.

Paleoecology and Human Impact from «Extra» Microfossils

B. van Geel (The Netherlands) gave a course called «Algae, Fungal Spores, and Animal Remains in Pollen Slides – Their Morphology, and Ecology» at the Institute of Botany, Bern, Switzerland, 23-26 Jan. 1995. Fifteen palynologists from various central European countries participated. In a series of lectures, van Geel showed that these extra fossils, combined with pollen, help in reconstructing local vegetation in the past more faithfully than can be achieved with pollen alone. They can also be used to infer and distinguish various kinds of human impact, such as grazing, deforestation, or burning. A better assessment of human impact in the past will help to more clearly separate anthropogenic and climatic signals in palynological diagrams.

Report by P. van der Knaap, TEL: +41-31-631 3868; FAX: +41-31-332 2059; E-Mail: knaap@sgi.unibe.ch.

High Resolution of Past Climate from Monsoon Asia: the Last 2000 Years and Beyond

A special issue of the Terrestrial, Atmospheric, and Oceanic Sciences Journal (vol. 5, No. 3, Sept. 1994) has been devoted to «High Resolution of Past Climate from Monsoon Asia: the Last 2000 Years and Beyond.» Edited by D. Sheu, R. Bradley, and W.-C. Wang. It includes papers arising from a PAGES workshop held in Taiwan, Dec. 1993.

PAGES/SSC Membership Appointments

PAGES has the pleasure of welcoming the following new members of the Science Steering Committee:

- Prof. Frank Oldfield; Dept. of Geography, University of Liverpool, UK; Use of lacustrine and near-shore marine sediments for reconstruction of environmental change. Expertise in short-lived radio-isotopes, pollen analysis, paleoecology and the human impact of climate change.
- Dr. Martin H. Iriondo; CONICET, Parana, Argentina; Quaternary environments and climate change of non-permanent deserts of South America with research focus on sedimentological and geomorphological analysis.
- Prof. William Ruddiman; Dept. of Environmental Sciences; University of Virginia, USA. Orbital-scale and last-deglacial climate responses in the North and tropical Atlantic. Long-term evolution of climate including the role of tectonic uplift in altering atmospheric circulation.
- Dr. Yugo Ono; Laboratory of Geocology; Hokkaido University, Sapporo, Japan. Paleoenvironment and paleometeorology of eastern Asia.
- Dr. E. A. Vaganov; Institute of Biophysics, Krasnoyarsk, Russia. Tree rings, paleoclimate information from organic material, paleoclimate of Siberia.

PAGES information on internet

PAGES information is available on Internet's World-Wide Web (WWW) through the public-domain program MOSAIC. Mosaic (in different flavors for different computers) can be obtained from the National Center for Supercomputing Applications at the University of Illinois, via an anonymous ftp to ftp.ncsa.uiuc.edu. The address of PAGES «home page» (the location of information in Mosaic) is: <http://www.ngdc.noaa.gov/paleo/pages.html>. The PAGES home page can also be reached through the World Data Center (WDC)-A paleo page: <http://www.ngdc.noaa.gov/paleo/paleo.html>. PAGES information is currently being maintained by J. Overpeck's group at NOAA in Boulder. In addition to PAGES information, such as workshop reports and meeting schedules, a wide variety of paleo-data sets are available from either Mosaic page.

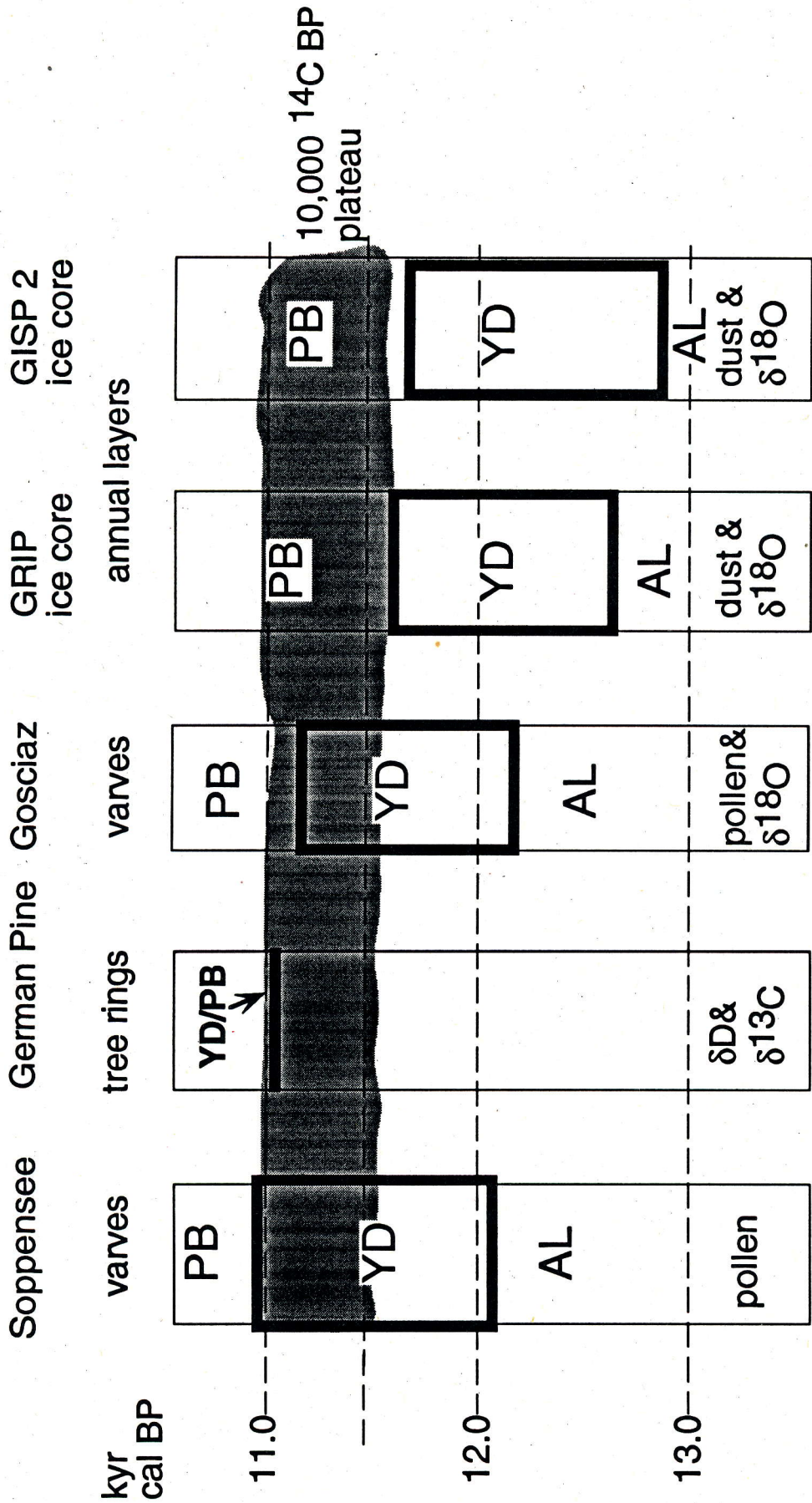
PAGES Core Project Office
Bärenplatz 2
CH-3011 Bern, Switzerland
Tel: +41-31/312-31-33
Fax: +41-31/312-31-68
E-Mail: pages@ubclu.unibe.ch

Newsletter Editors: Suzanne A.G. Leroy,
Steven M. Colman

PAGES CALENDAR

- * 30 March – 2 April 1995, PAGES **PEP III Principal Investigators** Workshop; Sfax, TUNISIA. Contact: F. Gasse FRANCE (TEL: +33-1-6941 6756; FAX: +33-1-6446 5938; E-MAIL: gasse@psisun.u-psud.fr).
- * 2–7 April 1995, PAGES workshop on the **Himalayan-Tibetan plateau paleoclimate**; Kathmandu, NEPAL. Contact: C. Wake, USA (FAX: +1-603-862 2124; E-MAIL: c_wake@unh.edu).
- * 3–7 April 1995, EGS symposium on **Geophysical evidence of the past and present climate change**; Hamburg, GERMANY. Contact: S. M. Klosko, Greenbelt, MD, USA (TEL: +1-301-441 4124; FAX: +1-301-441 1853; E-MAIL: zcsmk@gibbs.gsfc.nasa.gov) or H.-P. Plag, GERMANY (FAX: +49-431-880 4432).
- * 20–21 April 1995, International symposium on **CO₂-a challenge for mankind**; Berne, SWITZERLAND. Contact: C. Kost, SWITZERLAND (TEL: +41-31-631 4940; FAX: +41-31-332 2059).
- * 24–26 April 1995, IGBP regional conference on Global Environmental Change: implications for Southern Africa with a session on **Past Global Change**; Pretoria, SOUTH AFRICA. Contact: L. Botten, SOUTH AFRICA (TEL: +27-12-841 4429; FAX: +27-12-841 3791; E-MAIL: louise@frd.ac.za).
- * 3–7 May 1995, Society for American Archaeology meeting on **Palaeoenvironmental research in the Indo-Pacific region**; Minneapolis, MN, USA. Contact: J.C. White, USA (E-MAIL: banchang@vax.museum.upenn.edu).
- 20–24 May 1995, ESF workshop on **Palaeohydrology as reflected in lake-level changes as climatic evidence for Holocene times**; Lund, SWEDEN. Contact M. Fratta, FRANCE (FAX: +33-88 370532).
- 30 June–3 July 1995, PAGES-GFZ workshop on **Continental drilling for paleoclimatic records**; Postdam, GERMANY. Contact: S. Colman, Switzerland (TEL: +41-31-312 3133; FAX: +41-31-312 3168; E-MAIL: colman@pageigbp.unibe.ch).
- * 3–10 August 1995, PAGES symposia at the **INQUA** Congress; Berlin, GERMANY.
1. **Paleoclimate of the Southern Hemisphere during the last 140,000 years: metachronous with that of the Northern Hemisphere?** Contact: J.-C. Duplessy, FRANCE (TEL: +33-1-69 823526; FAX: +33-1-69 823568; E-MAIL: duplessy@eole.cfr.cnrs-gif.fr).
 2. **Paleomonsoon variations and global change during the Late Quaternary.** Contact: S. Kröpelin, GERMANY (TEL: +49-30-838 4887; FAX: +49-30-838 4882; E-MAIL: skroe@fub46.zedat.fu-berlin.de).
- * 14–18 August 1995, PAGES PEP II – PEP III session on **Paleogeographical and historical dimensions of global change** at the International Geographical Union; Moscow, RUSSIA. Contact: A. Velichko, RUSSIA (TEL: +7-095-238 0298; FAX: +7-095-230 2090).
- * 21–25 August 1995, 1st International Limnogeological Congress on **Research methods in ancient and modern lacustrine basins**; Copenhagen, DENMARK. Contact: N. Noe-Nygaard, DENMARK (TEL: +45-35-322 491; FAX: +45-35-322 499).
- * 22–25 August 1995, international conference on **Past, present, and future climate**; Helsinki, FINLAND. Contact: P. Heikinheimo, FINLAND (FAX: +358-0-774 882 99; E-MAIL: pirkko.heikinheimo@aka.fi).
- * 4–8 September 1995, 3rd International conference on **Modelling of global climate change and variability**; Hamburg, GERMANY. Contact: L. Dümenil, Hamburg, GERMANY (TEL: +49-40-41173 310; FAX: +49-40-41173 366).
- 18–22 September 1995, ESF symposium on **Ice sheet modelling**; Chamonix Mont-Blanc, FRANCE. Contact: P. Pirra, ESF, 1 quai Lezay-Marnésia, F-67080 Strasbourg Cedex, FRANCE.
- * 25–29 September 1995, **GAIM science conference**; Garmisch-Partenkirchen, GERMANY. Contact: D. Sahagian, Durham, NH, USA (TEL: +1-603-862 1792; FAX: +1-603-862 1915; E-MAIL: gaim@unh.edu).
- 7–12 October 1995, ESF conference on **The ecological setting of Europe, from the past to the future: the establishment of plant and animal communities in Europe since the Last Glaciation**; La-Londe-les-Maures, FRANCE. Contact: B. Berglund, SWEDEN (TEL: +46-46-107 886; FAX: +46-46-104 830; E-MAIL: bjorn.berglund@geol.lu.se).
- * 9–11 December 1995, international conference of the IGCP 349 on **Quaternary deserts and climatic change**; Al Ain, UAE. Contact: A. S. Alsharhan, UAE (FAX: +971-3-620 486).
- * 17–22 December 1995, symposium of the International Chemical Congress of Pacific Basin Rim Societies on **Volcano-atmosphere interactions**; Honolulu, USA. Contact: R. Andres USA (FAX: +1-907-474 6087; E-MAIL: ffrja@aurora.alaska.edu).
- * 23–25 October 1995, open session of the SAC IV on **Natural and anthropogenic changes in Asia: impacts on global biogeochemical cycles**; Beijing, CHINA. Contact: IGBP, SWEDEN (TEL: +46-46-816 6448; FAX: +46-46-816 6405).

* Open meetings. All interested scientists are invited to attend.



Timing of the Younger Dryas climatic event estimated by varve counting (Soppensee, Gosciarz), dendrochronology (German Pine), counting annual bands in ice cores (GRIP, GISP 2) is shown on a common time scale of calendar years BP. The shaded area corresponds to the 10 kyr 14C plateau (11 to 11.6 kyr cal BP).

Radiocarbon and Absolute Dating of the Younger Dryas Climatic Event

Irka Hajdas, EAWAG CH-8600 Dübendorf and Institut für Teilchenphysik, ETH Hönggerberg, CH-8093 Zürich, Switzerland. Ph: +41-1-633 2042 ; Fax: +41-1-633 1067; E-mail: hajdas@imp.phys.ethz.ch

Early studies of the radiocarbon ages associated with the Younger Dryas (YD) climatic event placed this event boundaries between 11 and 10 kyr BP (Mangerud et al., 1974). These were the most common radiocarbon ages for the onset transition from the warm Allerød to the cold YD and for the terminal transition from the YD to the warm Preboreal (PB). It is now evident that these ages are not precise enough to give a satisfactory determination of the timing and duration of this event. The major problem is the long radiocarbon age plateau at 10 kyr BP. This is a period of time when radiocarbon ages remain constant due to a decrease in the $^{14}\text{C}/^{12}\text{C}$ ratio in the atmosphere, and does not allow precise absolute dating of the YD/PB boundary when radiocarbon calibration is applied. Moreover, the established radiocarbon calibration curve reaches back only to 10 kyr BP, i.e. shortly before the beginning of the Holocene (Kromer and Becker, 1993).

A more reliable time scale is critical for understanding the causal mechanism for the abrupt YD cooling. As the YD has been recognised around the globe (Alley et al., 1993), precise dating of the event is also essential for elucidating the interhemispheric link of climate mechanisms. Recently, the calendar ages of the onset and termination of the event have been determined by studies of various high resolution records (e.g. ice cores, laminated sediments and tree rings). A comparison between these studies (figure) shows certain similarities, but also differences which are not yet explained.

The absolute time scale of the Late Glacial, as recorded in GRIP and GISP2 ice cores, yield a duration for the YD of 1150 (Johnsen et al., 1992) and 1300 ± 70 years (Taylor et al., 1993), respectively. A comparable duration of 1140 years is found in annually laminated lake sediments of Soppensee in Switzerland (Hajdas et al., 1993) and Gosciarz in Poland (Goslar et al., 1993). In sediments of both lakes, the event has been recognised in pollen spectra and a sudden change in stable isotopes (Goslar et al., 1993).

However, there is an offset between the absolute age of the YD/PB transition in ice cores and the Soppensee record (figure). Whereas data from ice cores place it at 11,580 (GRIP; Johnsen et al., 1992) and 11,640 (GISP 2; Taylor et al., 1993), i.e. just at the beginning of the 10 kyr plateau, the Soppensee varve chronology dates the transition at ca. 11 kyr cal BP, which is at the end of the age plateau. A similar age of ca. 11 kyr also comes from tree ring data (Kromer and Becker, 1993); the transition in this record is based on variations of δD and $\delta^{13}\text{C}$ in wood (Becker et al., 1991). In sediments of Lake Gosciarz this event was dated at 11,200(+500/-200) yr cal BP (Goslar et al., 1993).

For the time being the difference of up to 500 years in dating the YD/PB transition remains an open question. Precise radiocarbon dating of various proxy data from different records on the globe can help to solve this problem.

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